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STUDY TO DEMONSTRATE THE FEASIBILITY OF AND DETERMINE THE OPTIMUM METHOD OF REMOTE HAZE MONITORING BY SATELLITE

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Interim Report for Period October 1972 - March 1973

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(E73-10691) STUDY TO DEMONSTRATE THE FEASIBILITY OF AND DETERMINE THE OPTIMUM METHOD OF REMOTE HAZE MONITORING BY SATELLITE Interim (Aerospace Corp., Los Angeles, Calif.) 37 p HC $3.00 CSCL 04B

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PROGRESS REPORT

INTRODUCTION

Progress during the period 1 October 1972 - 31 March 1973 in the Study to Demonstrate the Feasibility of and Determine the Optimum Method of Remote Haze Monitoring by Satellite is described in this report. Accomplishments in this period included gathering of ground truth data during ERTS-1 gasses and analysis of digital tapes from several gases. No problems were encountered that will impede the progess of the study.

Accomplishments during this period:

Ground Truth

Ground truth was gathered as planned during the ERTS-1 passes. A detailed description of the various types of ground truth was presented in the previous type II progress report covering the period 10 May 1972 - 30 September 1972, E73-10346.

Through the end of November, ground truth was obtained not only for the pass over Los Angeles, which is the heart of our test area, but also for the adjacent pass, one day earlier, over San Bernardino, which is on the edge of our test area. Although data over San Bernardino is less useful and the required ground truth more difficult to obtain because of the unpredictability of the weather and the fact that some spaceborne sensors have been short lived, we thought it wise to cover all possible passes until a minimum amount of data useful for our analysis was obtained.

A summary of the ground truth data obtained at the time of ERTS-1 passes over our test area during this reporting period is given in Table I.

TABLE I

Date	Data Obtained*	Notes
2 Oct 72	a) b) c) d)	Partly cloudy. Probably too cloudy for analysis.
3 Oct 72	a) b)	Very cloudy.
20 Oct 72	a) b)	Very cloudy.
21 Oct 72	a) b) c) d)	Ideal conditions, ranging from quite hazy to clear. Complete ground truth.
7 Nov 72	a) b)	Very cloudy.
8 Nov 72	a) b) c) d)	Ideal data, very clear, will make good comparison with 21 Oct 72 data.
25 Nov 72	a) b) c) d)	High cirrus might confuse a haze analysis.
26 Nov 72	a) b) c) d)	Good data. Clear.
14 Dec 72	a) b)	Cirrus makes haze analysis questionable.
1 Jan 73	a) b)	Holiday.
19 Jan 73	a) b)	Partly cloudy, very little haze.
6 Feb 73	a) b)	Very cloudy.
24 Feb. 73	a) b)	Very cloudy.
14 Mar 73	a) b) c) d)	Clear. Hope for a hazy day soon for comparison.

* a) Visibility data from airports.

b) Air Pollution Control District data.

c) Aureole Monitor.

d) Visual and Photographic data
Altitude of the top of the haze layer.
Vertical temp. profiles

a) and b) are obtained from outside sources.
c) and d) are actively gathered by the Contractor specifically for this analysis.
For a more complete description, see the previous Phase II Report.

These data are compiled in the Appendix, except for the photographs. Examples of these photographs are shown in Fig. 2 through Fig. 7 comparing haze conditions on 21 October with 8 November. All photographs were made using a Honeywell Pentax Spotmatic 35 mm camera, with a 50 mm f 11.4 Super-Multi-Coated Takumar Lens. A UV filter was fitted to the lens. The Kodachrome II film was processed by Kodak. Exposures were made at 1/500 sec, f/4.9. The prints shown in Fig. 2 through Fig. 7 were all processed in the same manner in order to display as accurately as possible the relative haze conditions prevailing during the 8 November 1972 and 21 October 1972 ERTS-1 passes over the test area.

We are very pleased with the 21 October and 8 November data. During the 21 October ERTS-1 pass, much of the test area was quite hazy (see Figures 3, 5, 7). There were also regions of moderate and light haze as well as clear areas. At the time of the 8 November pass, most sections of the test area, including regions that were hazy on 21 October, were quite clear. We had complete ground truth for both passes, and both were, for the most part, cloud free. Changes in terrain features are minimal because these were consecutive passes. Therefore, comparisons of the two images is expected to reveal the effects of haze on ERTS-1 images, and to indicate the optimum method of haze detection from a satellite.

The winter was often cloudy and generally haze free. We hope to obtain two consecutive passes in the spring, one hazy and one clear, to form a set like the 21 October and 8 November data. This is desirable because both terrain and meteorological patterns in the spring are different from those of the fall.

Data Analysis

Digital tapes for the 21 October 1972 and 8 November 1972 passes over our test area were obtained. The "Observation identifiers" for these frames are 1090 - 18012 and 1108 - 18014.

The tapes were copied. The analysis proceeded with the copies, while the originals were stored in a safe place. This was necessary because our

computer handles tapes in a rather rough manner. On two occasions our working tapes have developed errors and new copies had to be made from the originals.

The data from parts of the digital tapes was dumped. The printout was examined to check format, etc.

Images were produced by the Calcomp 835 film plotter associated with our computer. Examples of such images are shown in Figures 8, 9 and 10. 32 grey shades are available. Ordinarily these are spread uniformly over the entire range of brightness data from the ERTS-1 digital tapes, however, they could be placed in any correspondence that one desires. 35 mm Panatomic-x film is used in the Calcomp film plotter. We have found 4 minutes in D-96 at 70°F to yield optimum processing of this film. In the prints shown in Figures 8, 9 and 10 the highlights have been compressed, i.e., clouds do not appear as much brighter than the terrain as they really are. This was done to increase contrast in the terrain part of the image.

This pictorial capability was developed in order to precisely locate on the images the elements in a digital analysis, and to display the results of numerical manipulation, e.g. ratios or differences of two images.

Intensity plots for all MSS bands were made along selected scan lines for the 21 October 1972 and the 8 November 1972 frames. An example of part of one scan line of the 21 October 1972 frame is shown in Fig. 11. A part of the corresponding line from the 8 November 1972 data is shown in Fig. 12. Images from MSS bands 5 and 7 were made from the digital tapes of both the 21 October and 8 November data. Each image is composed of 12 prints like Figures 8 or 9 or 10 joined together to cover an area 100 miles wide by about 45 miles high. Stripes were included in these images in order to precisely locate the scan lines that were plotted. Four prints like Figures 11 or 12 were mounted side by side in order to show an entire scan line.

These intensity plots and associated ERTS-1 images were produced as the first step in the data analysis. Examination of these plots will indicate fruitful directions in which to continue the analysis. These data are still being studied, but some results are already apparent.

The darkest areas, typically water, are brighter on the hazy day. This effect is so consistent over the ocean, harbors and lakes that it is almost certainly an atmospheric effect rather than a variation in surface reflectivity. The absolute increase in brightness decreases with increasing wavelength. The fractional increase is greatest for bands 5 and 6, in which the darkest areas are 50% brighter on the hazy day than on the clear day.

The absolute variation in brightness of light areas, e.g. sand, is not as large as that for dark areas between clear and hazy days. This results in a net loss of contrast on the hazy data. However, the loss is a small fraction of the original scene contrast for the area being studied. This is apparent from comparison of Figures 11 and 12 and from comparison of Figures 9 and 10. Figures 9 and 10 were produced in the same way. The dark areas are somewhat brighter on the hazy day, Fig. 9, then on the clear day, Fig. 10. There is less difference in the lighter areas. However, the image shown in Fig. 9 appears to be just as useful for most purposes as the image shown in Fig. 10.

Accomplishments planned for the next reporting period:

We will continue to analyze the 21 October 1972 and 8 November 1972 data in order to determine the optimum method of remote haze monitoring by satellite. The next step will be to produce histograms of point brightness values over selected areas, and to produce power spectra for selected sections of certain lines. These calculations will be made for all bands, over several common locations from the 21 October 1972 and 8 November 1972 data.

We will continue to obtain ground truth data at the times that ERTS-1 passes over our test area.

Significant Results

Ground truth data has been obtained, in order to determine the amount of haze present at the time of ERTS-1 passes over the Los Angeles area. 21 October 1972 was the haziest day, that was essentially cloud free, to date. At the time of the next pass, 8 November 1972, this area was quite clear,

i.e., haze free. Changes in terrain features are minimized because these were consecutive passes. Digital tapes of the ERTS-1 data from these two days are being analyzed to determine the effects of haze on the data, in order to determine the optimum method of monitoring haze from a satellite. Preliminary results indicate that a slight reduction in contrast and some distortion of spectral signatures are caused by heavy haze. This effect is thought to be sufficient to determine the presence of moderate haze without the benefit of ground truth data. It is significant to note that there is very little degradation in ERTS-1 data caused by a rather heavy haze. For many purposes the data obtained on a hazy day is just as useful as that obtained on a clear day.

FIGURE CAPTIONS

Fig. 1 Map of the Test Area showing airports where visibility data are obtained (1-9), and the locations where air pollutants are monitored (A-L).

Fig. 2 The Virginia Country Club, Long Beach (near location 6 on Fig. 1). 8 Nov 72. From 4,500' altitude. Looking NNE. 18 minutes before the pass of ERTS-1.

Fig. 3 The Virginia Country Club, Long Beach (near location 6 on Fig. 1). 21 Oct 72. From 4,500' altitude. Looking NNE. 43 minutes before the pass of ERTS-1.

Fig. 4 Hollywood Park, Inglewood (between locations 1 and H on Fig. 1). 8 Nov 72. From 4,500' altitude. Looking NE. 9 minutes before the pass of ERTS-1.

Fig. 5 Hollywood Park, Inglewood (between locations 1 and H on Fig. 1). 21 Oct 72. From 4,500' altitude. Looking ENE. 30 minutes before the pass of ERTS-1.

Fig. 6 Looking NE. 3,500' altitude over Culver City (between locations 1 and D on Fig. 1). 5 minutes before the ERTS-1 pass. The distance to the nearest mountain range is 26 miles.

Fig. 7 Looking ENE. 4,500' altitude over Santa Monica (near location D on Fig. 1). 25 minutes before the ERTS-1 pass. The distance to the nearest mountain range, the same as that shown in Fig. 6, is 23 miles.

Fig. 8 ERTS-1 MSS Band 7 image produced from digital tapes by the investigators. A 24 x 12 mile area in the southwest part of the Los Angeles basin is shown from the 21 Oct 72 pass. The area shown was quite hazy at the time of the ERTS-1 pass. White strips are included to precisely locate specific frame lines, in order to correlate the digital analysis with the visual image.

Fig. 9 Similar to Fig. 8, except this image was produced from MSS Band 5 data.

Fig. 10 ERTS-1 MSS Band 5 image produced by the investigators from digital tapes of the 8 Nov 72 pass. The area shown is roughly the same as that in Figures 8 and 9. This area was quite clear (haze free) at the time of the ERTS-1 pass. The white strips are included to precisely locate specific frame lines.

Fig. 11 Intensity plots for all MSS bands along line 1871, from the same frame of data as Figures 8 and 9. Lines 1865 and 1875 are marked on Figures 8 and 9, thus line 1871 can be accurately located. The east-west extension, i. e. range of point numbers, is the same for Fig. 11 as it is for Figures 8 and 9. MSS bands 4, 5, 6 and 7 are plotted in order from bottom to top.

Fig. 12 Intensity plots for the line (1788) of the 8 Nov 72 data that most nearly coincides with the line plotted in Fig. 11 from the 21 Oct 72 data. There is an along scan shift, because the frames from these two passes do not exactly overlap. These plots are from the same frame of data as Fig. 10. Lines 1780 and 1790 are marked on Fig. 10, therefore line 1788 can be accurately located.

APPENDIX

Ground Truth Data

Visual observations of the haze conditions over the Test Area at the times of ERTS-1 passes.

2 Oct. 1972, Pass over San Bernardino. Broken clouds, bottoms around 2,500', tops about 5,500'. The haze is very light, and does not appear to vary significantly over the Test Area. The haze tops at about the same altitude as the clouds tops. Probably too cloudy for analysis.

21 Oct. 1972, Pass over Los Angeles. Very smoggy day. Smog tops at 3,500' at Torrance(7) and LAX(1), slightly higher inland. Heavy haze over the entire L. A. basin. (A, B, D, E, G, H, I, L, 1, 4, 5, 6, 7) Moderate haze over the San Fernando Valley(F, 2, 3), decreasing toward the north end of the valley. There is a clear area around Sylmar. It is clear in the Newhall area (J). It is clear over Palmdale and Lancaster(K, 8).

8 Nov. 1972, Pass over Los Angeles. Very clear day. Los Angeles basin very clear west of Whittier(I) and Arcadia(B). Light haze over Orange County(5). Light to moderate or heavy haze and scattered clouds over Pomona(G) and Ontario(4). Very clear over the San Fernando Valley(F, 2, 3). Very light haze visible over toward Ventura.

25 Nov. 1972, Pass over San Bernardino. Scattered cirrus will probably confuse a haze analysis. Haze layer tops about 1,000' over Los Angeles basin. Not much effect looking down, but it probably looks thick looking horizontally from ground level. Haze patchy around Anaheim because it settles in low areas. Quite clear around Lake Mathews. Quite clear over Riverside and San Bernardino. Low thin layer of haze over Pomona(G) and Ontario(4), similar to Los Angeles basin.

26 Nov. 1972, Pass over Los Angeles. Much smog blown out to sea. Very thin layer of smog over the Los Angeles basin, 100 to 200' thick. In some places this layer is at ground level, in other places as much as 1,000' above ground level. Very clear over San Fernando Valley(F, 2, 3). Appears slightly hazier over Orange County(5) than over Los Angeles basin.

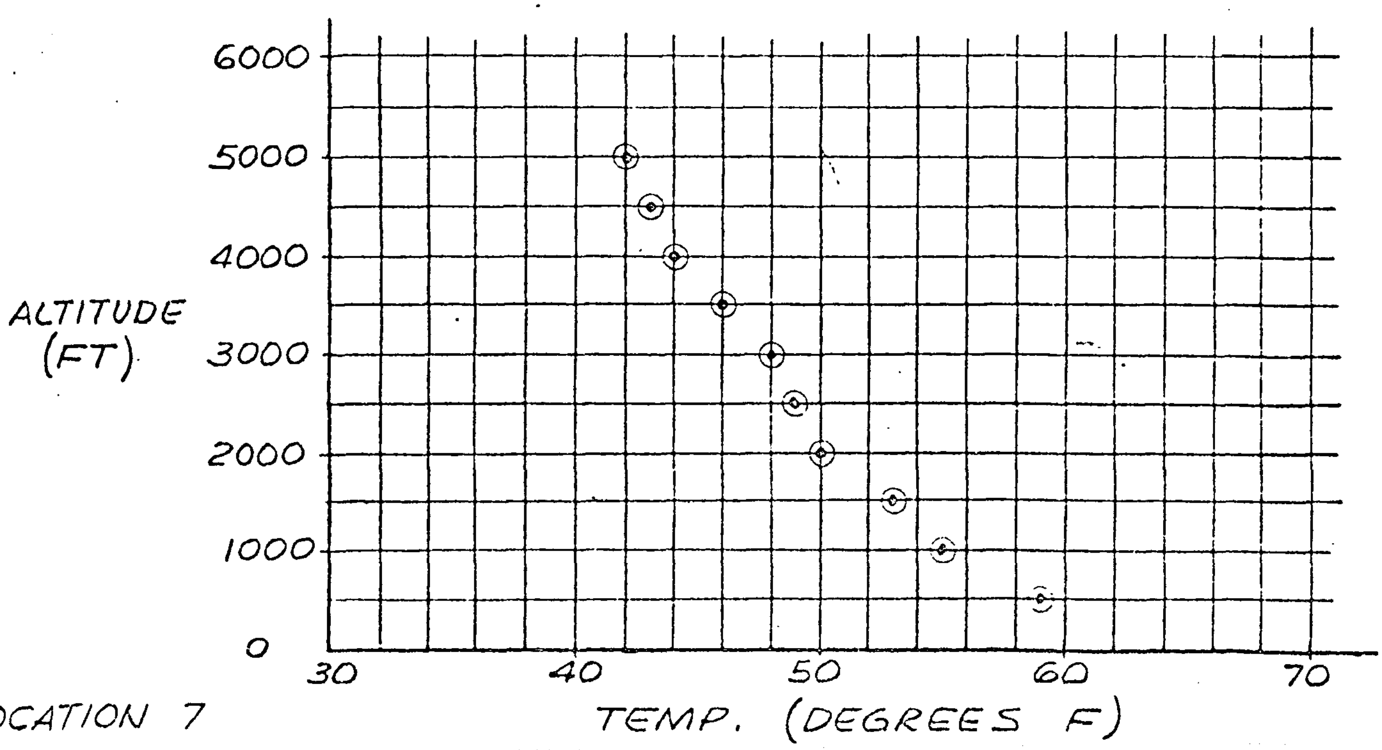
14 March 1973, Pass over Los Angeles. A very clear day. Just a hint of haze over Anaheim and Long Beach(6).

Numerical Data

Location of observations are shown on the map presented in Fig. 1.

DATE : 2 OCT 1972 TIME: 10:00 AM P.S.T.

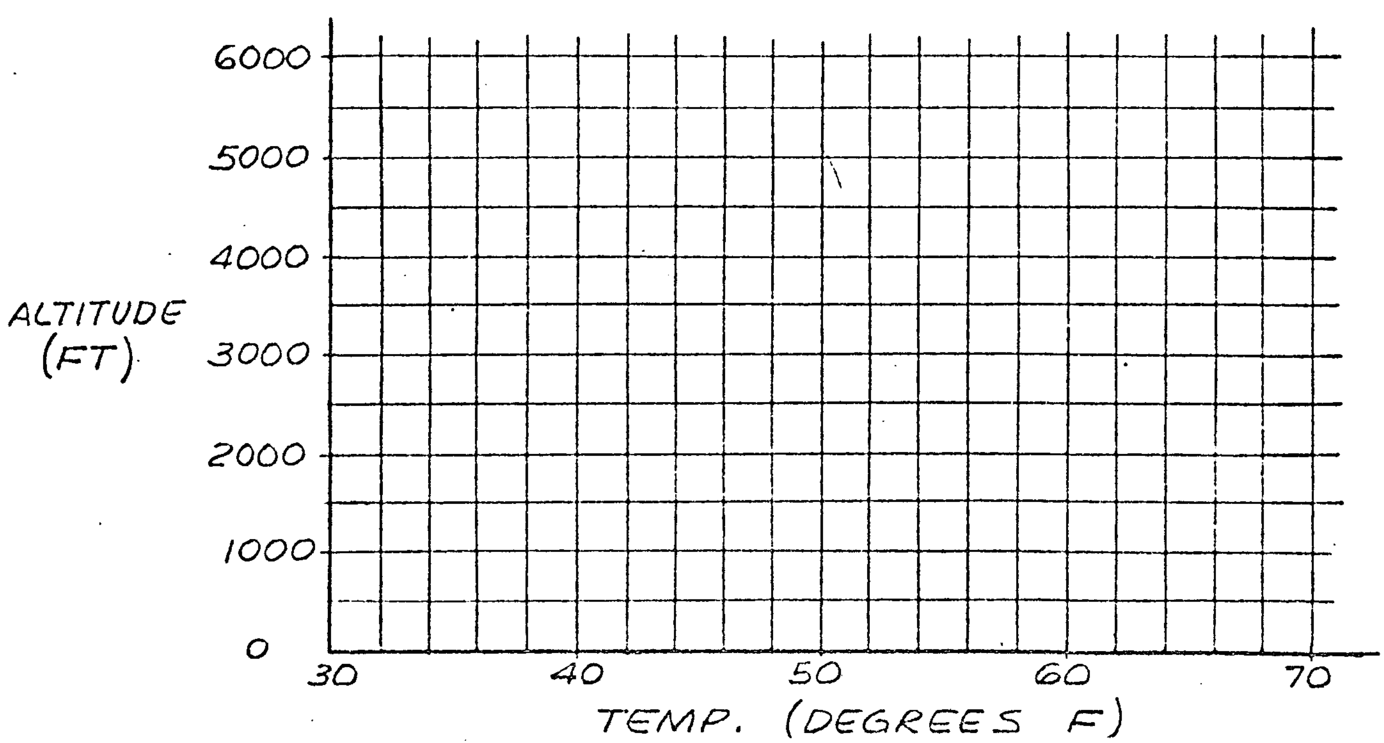
LOCATION	VISIBILITY (MILES)	NO (PPHM)	NO_2 (PPHM)	O_3 (PPHM)	HYDROCARBONS (PPM)	CH_4 (PPM)	CO (PPM)	SO_2 (PPHM)	PARTICULATE KM x 100
1	20								
2	10								
3	10								
4	15								
5	15								
6	20								
7									
8	25								
9	40								
A	20	2	8	1	3	3	2	1	18
B		1	1	2	4	3	2	1	11
C		2	6	2	2	2	4	1	13
D		1	5	1			2	1	13
E		4	2	2			6	1	15
F		1	4	3	3	3	1	1	20
G		4	3	3	2	2	4	1	10
H		8	6	1	2	2	1	2	11
I		2	3	2	2	2	3	1	
J		1	4	2	2	2	4		13
K		1	1	3	2	2	2		5
L		2	4	2	2	2	2	1	10



LOCATION 7

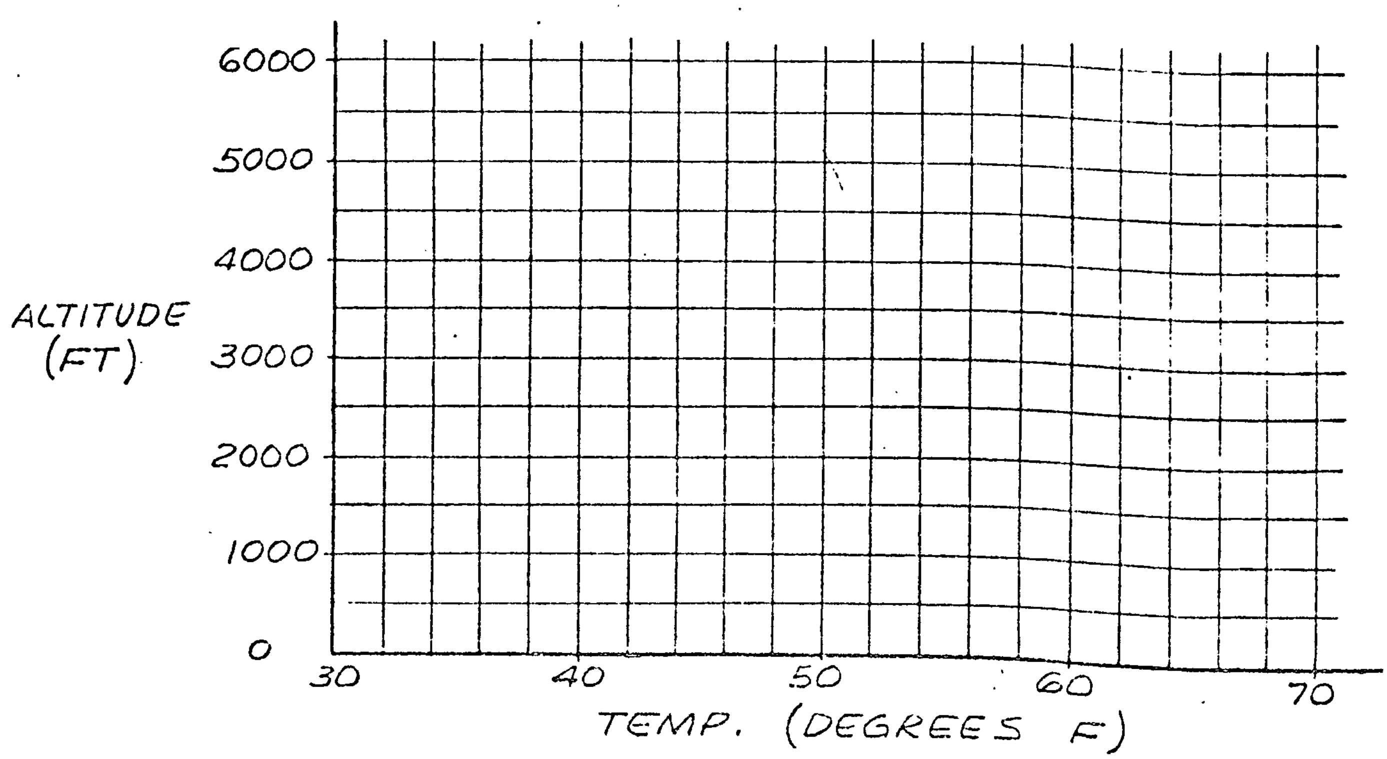
DATE : 3 OCT 1972 TIME: 10:00 AM P.S.T.

LOCATION	VISIBILITY (MILES)	NO (PPHM)	NO_2 (PPHM)	O_3 (PPHM)	HYDROCARBONS (PPM)	CH_4 (PPM)	CO (PPM)	SO_2 (PPHM)	PARTICULATE KM x 100
1	6								
2	10								
3									
4	7								
5									
6	7								
7									
8	15								
9									
A	6	10	8	4	4	3	4	3	36
B		5	7	3	3	2	4	1	29
C		11	7	4	4	3	4	2	25
D		9	7				5	1	42
E		12	11				6	2	35
F		8	5	4	4	4	4	1	33
G		4	6	2	2	2	4	1	20
H				3	3	3	6	5	33
I		7	9	3	3	2	8	4	
J		4	6	2	2	2	4	3	17
K		1	1	2	2	2	3		11
L		7	9	3	3	2	5	1	28



DATE : 20 OCT 1972 TIME: 10:00 AM P.S.T.

LOCATION	VISIBILITY (MILES)	NO (PPHM)	NO_2 (PPHM)	O_3 (PPHM)	HYDROCARBONS (PPM)	CH_4 (PPM)	CO (PPM)	SO_2 (PPHM)	PARTICULATE KM x 100
1	10								
2	5								
3	3								
4	4								
5	10								
6	12								
7									
8	20								
9	15								
A	6	11	7	3	3	2	5	1	45
B		1	3	3	3	2	2	2	13
C		6	5	3	3	3	4		23
D							4	2	30
E		19	7				3	3	35
F		6	8	4	4	4	3	1	32
G		6	6	2	2	2	5	1	23
H				3	3	2	5	1	45
I		11	7	3	3	3	4	2	
J		5	5	2	2	2	3	4	15
K		1	1	2	2	2	2	1	7
L		7	6	3	3	2	5	1	34



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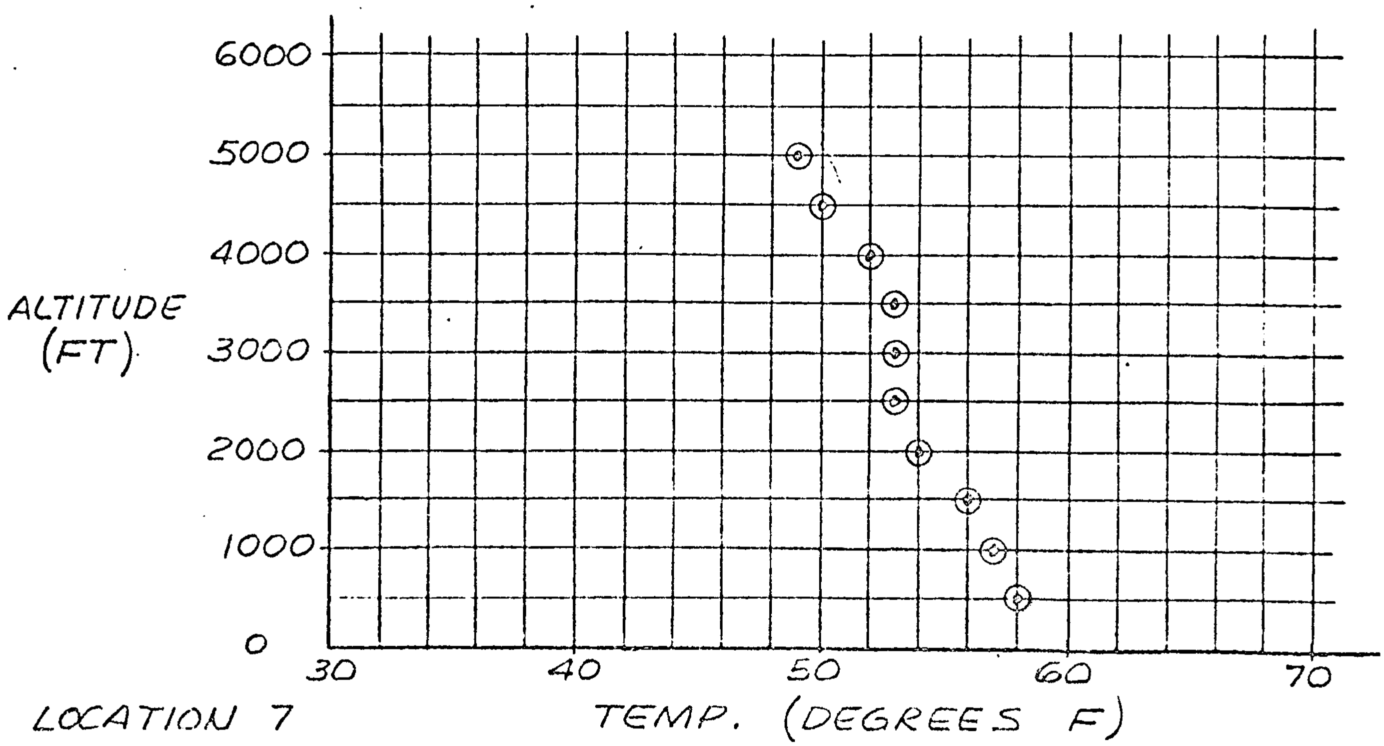
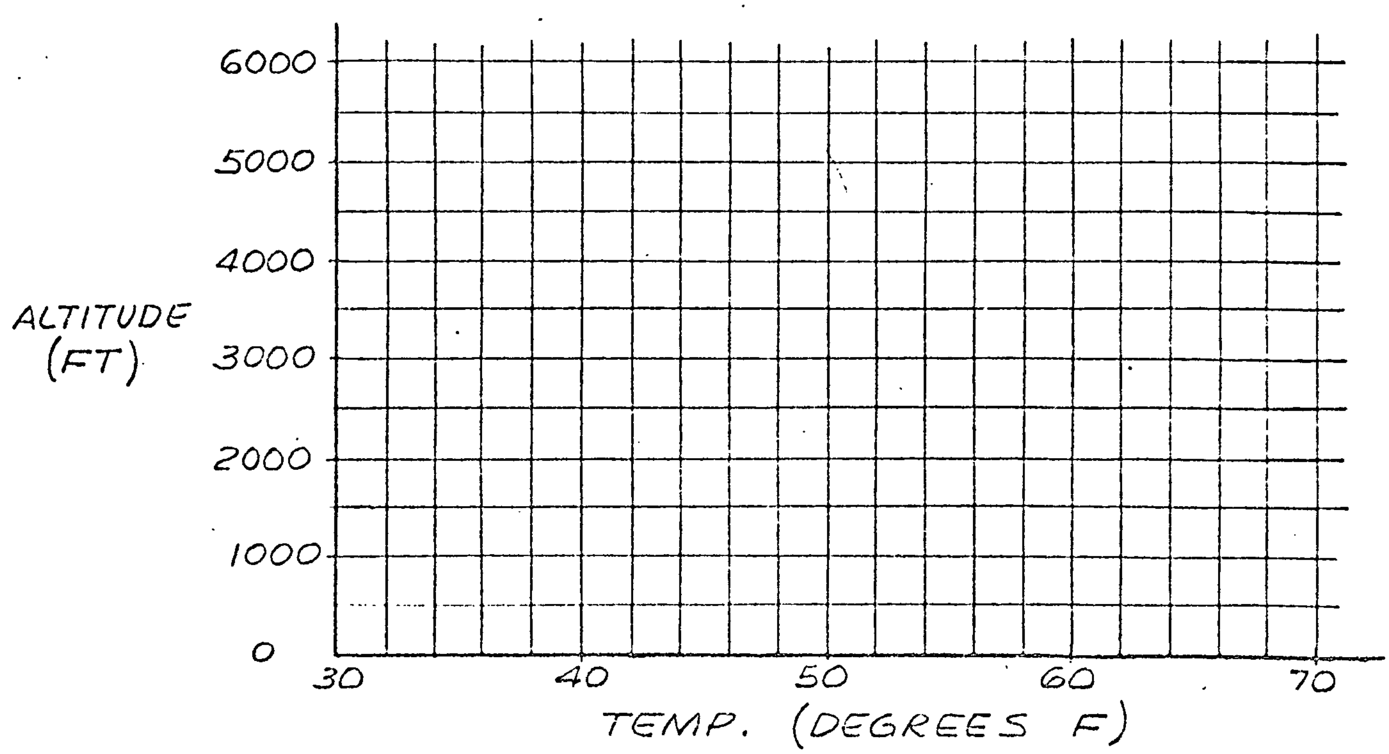
1	6								
2	5								
3	3								
4	1 1/2								
5	4								
6	3								
7	5								
8	30								
9	20								
A				4	2	2	4	2	34
B		2	6	4	3	2	3	1	23
C		2	8	5	3	3	5	1	28
D		5	10	4			3	2	21
E		10	13	1			3	31	28
F		1	5	5	3	3	1	1	26
G		4	7	4	2	2	5	2	19
H		8	8	1	3	3	3	10	20
I		4	11	2	3	2	4	3	
J		2	3	2	2	2	1	1	8
K		1	1	3	2	2	2		12
L		1	7	5	3	2	3	1	22



LOCATION 7

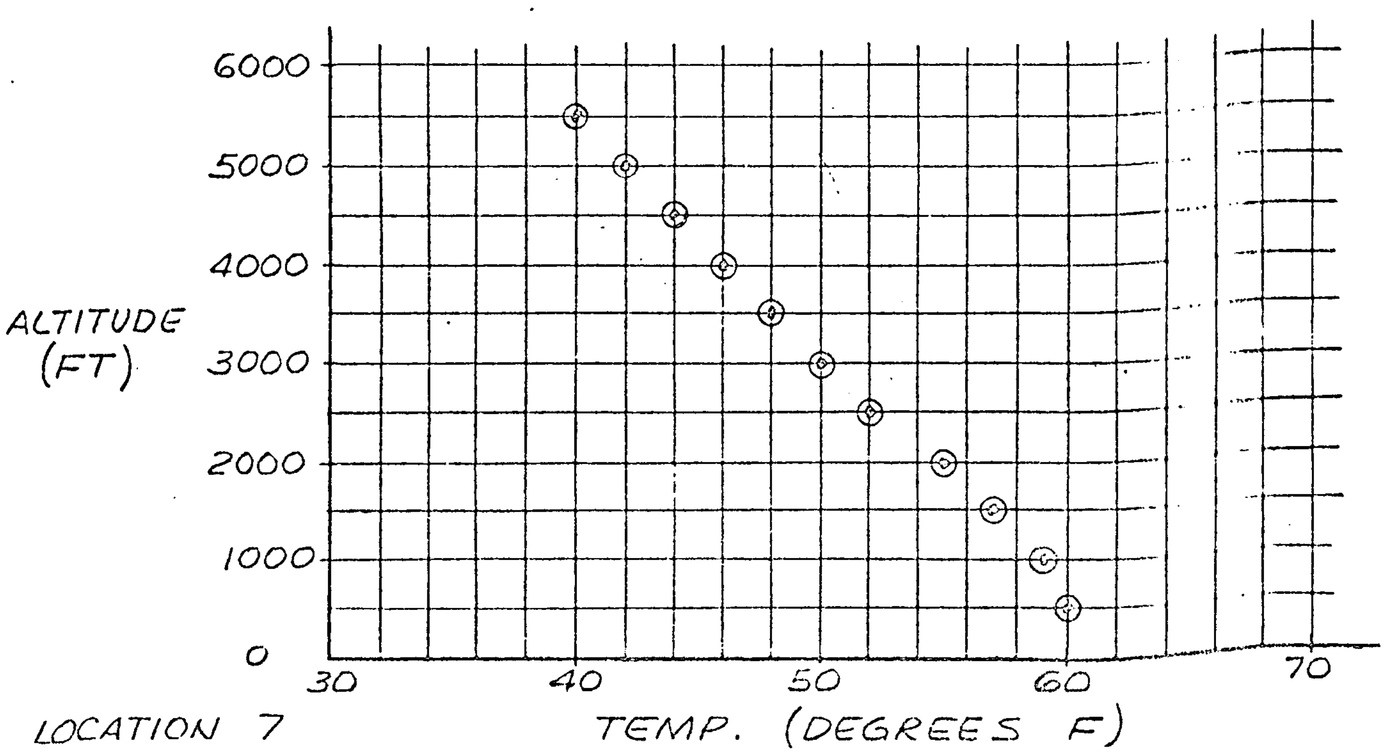
DATE : 7 NOV 1972 TIME: 10:00 AM P.S.T.

LOCATION	VISIBILITY (MILES)	NO (PPHM)	NO_2 (PPHM)	O_3 (PPHM)	HYDROCARBONS (PPM)	CH_4 (PPM)	CO (PPM)	SO_2 (PPHM)	PARTICULATE KM x 100
1	10								
2	3								
3									
4	4								
5									
6	3								
7									
8	25								
9									
A	6	8	9	3	3	2	5	2	38
B		6	12	7	7	6	5	3	50
C		4	11				3	2	31
D		3	7				3	2	15
E		12	9				3	3	30
F		14	21	5	5	4	7	3	52
G				3	3	2	6	2	27
H		7	7	2	2	2	3	2	20
I		4	11	3	3	3	5	3	
J		4	8	3	3	2	5	1	30
K		1	5	3	3	2	3	4	15
L		6	10	4	4	3	6	3	37



DATE : 8 NOV 1972 TIME: 10:00 AM P.S.T.

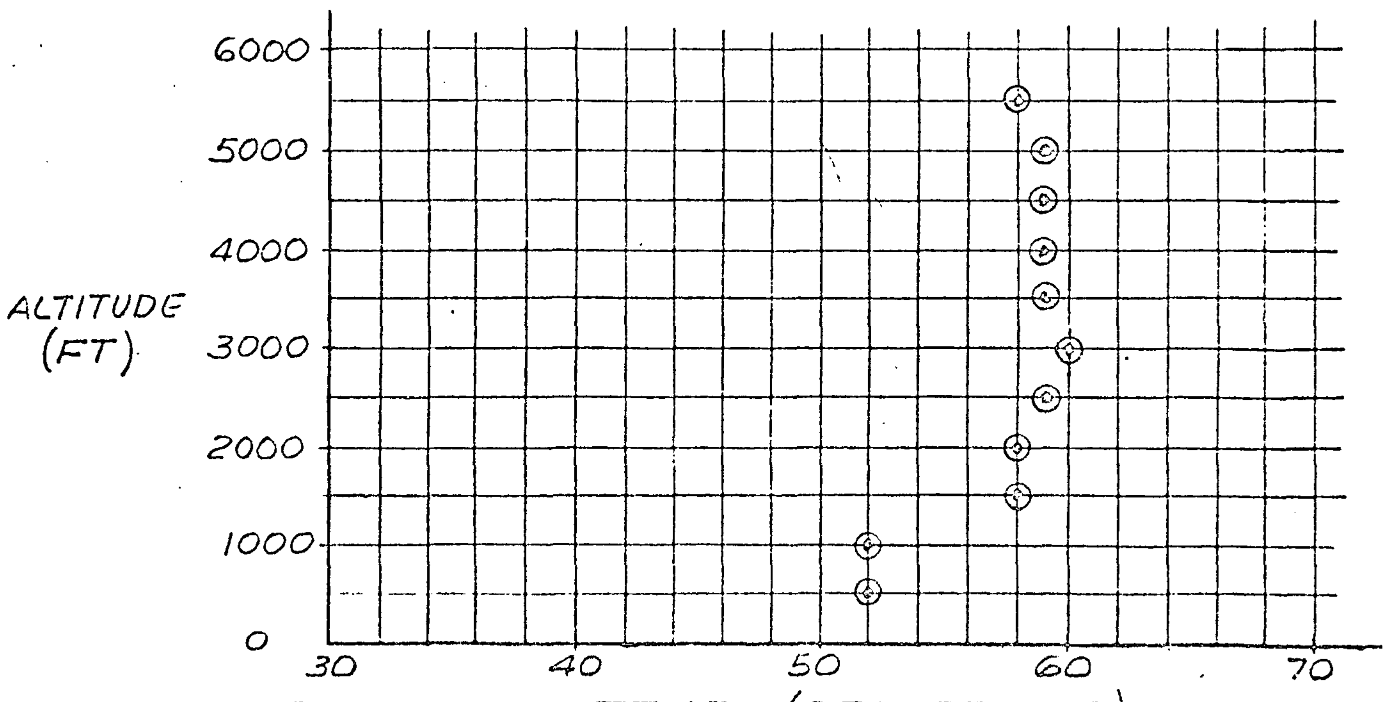
LOCATION	VISIBILITY (MILES)	NO (PPHM)	NO_2 (PPHM)	O_3 (PPHM)	HYDROCARBONS (PPM)	CH_4 (PPM)	CO (PPM)	SO_2 (PPHM)	PARTICULATE KM x 100
1	30								
2	40								
3	25								
4	4								
5	15								
6	30								
7	>15								
8	20								
9	40								
A	8	1	3	3	1	1	1	1	15
B		1	6	3	3	3	3	1	19
C		2	3	2	2	2	2	1	11
D		4	4	2			2	1	8
E		7	8	2			3	2	20
F		1	1	3	3	3	1	1	8
G				3	2	2	4	1	28
H		6	5	2	2	1	2	2	13
I		1	2	2	2	2	1	1	
J		1	1	2	2	2	1	1	9
K		1	1	2	2	2	2		8
L		1	2	3	2	2	2	1	5



LOCATION 7

DATE : 25 NOV 1972 TIME: 10:00 AM P.S.T.

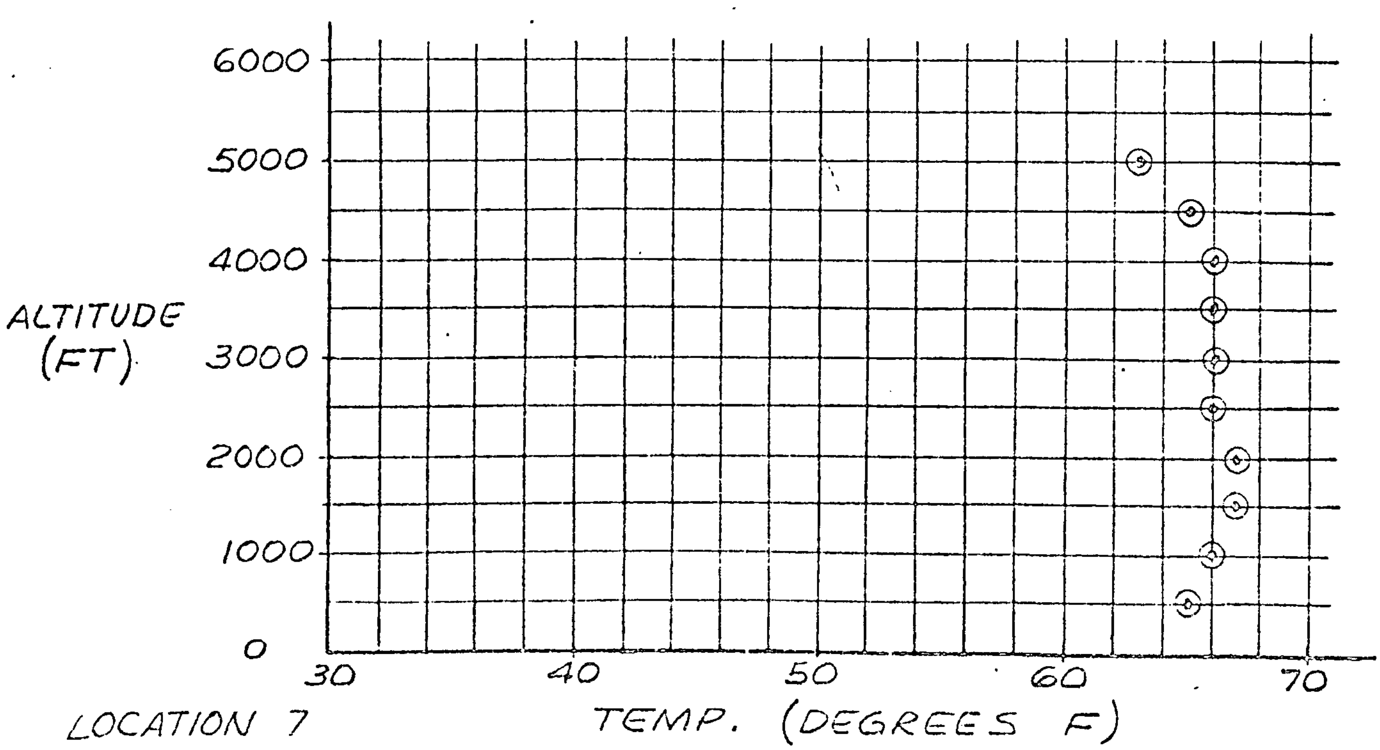
LOCATION	VISIBILITY (MILES)	NO (PPHM)	NO_2 (PPHM)	O_3 (PPHM)	HYDROCARBONS (PPM)	CH_4 (PPM)	CO (PPM)	SO_2 (PPHM)	PARTICULATE KM x 100
1	5								
2	40								
3	>50								
4	3								
5	6								
6	4								
7									
8	35								
9	40								
A	10	11	12	3	3	2	7	1	35
B		2	8	3	3	3	2		20
C		4	11	3	3	3	2	1	21
D		7	16	2			5	2	33
E		12	15	3			4	2	47
F		5		2	4	4	4	2	21
G		3	7	3	2	2	6	2	26
H		29	18	3	5	4	5	4	55
I		16	18	2			7	31	
J		2	1	2	1	1	4	1	10
K		1	1	1	2	2	2		15
L		2	7	4	3	2	3	2	17



LOCATION 7

DATE : 26 NOV 1972 TIME: 10:00 AM P.S.T.

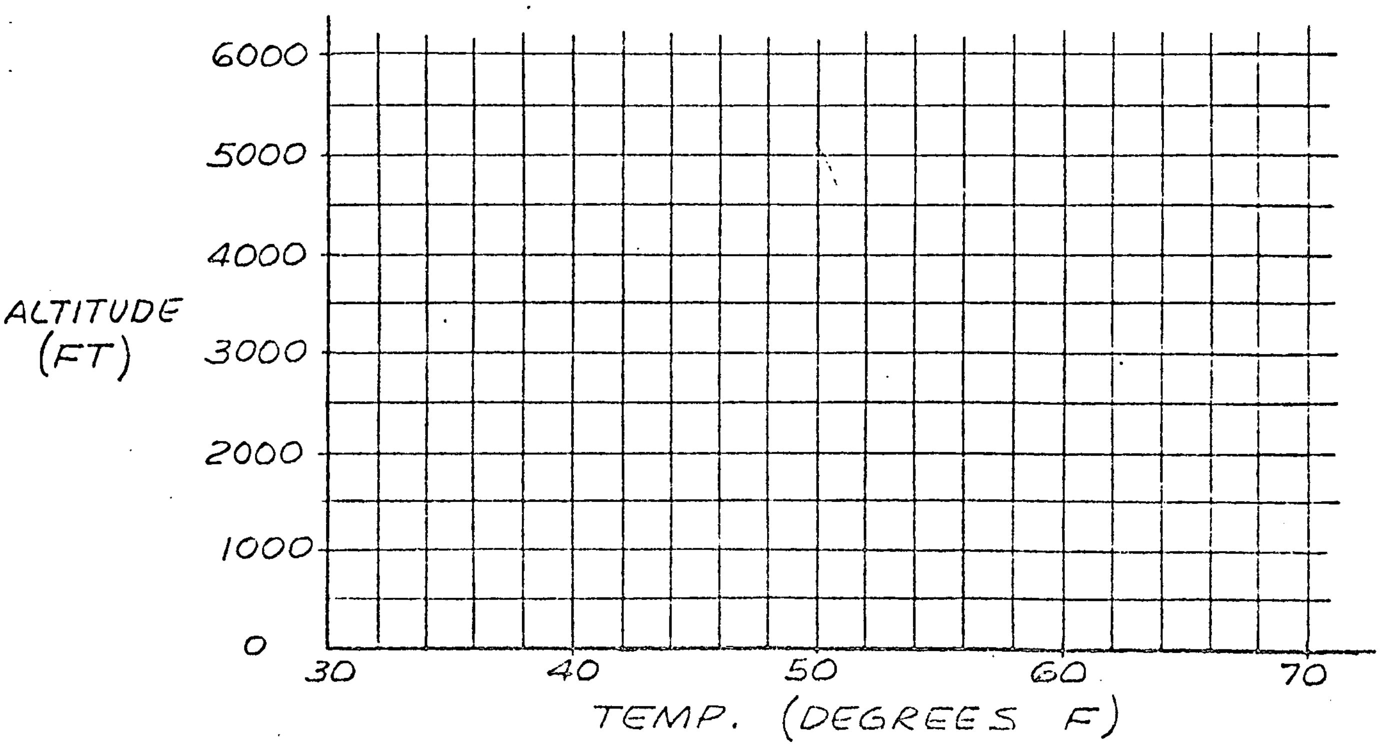
LOCATION	VISIBILITY (MILES)	NO (PPHM)	NO_2 (PPHM)	O_3 (PPHM)	HYDROCARBONS (PPM)	CH_4 (PPM)	CO (PPM)	SO_2 (PPHM)	PARTICULATE KM x 100
1	12								
2	50								
3	>50								
4	55								
5	3								
6	5								
7	>15								
8	35								
9	40								
A		2	5	1	2	2	3	1	15
B		1	2	2	2	2	1		9
C		5	12	4	4	3	3	1	20
D		4	15	4			4	1	24
E		11	25	5			7	1	58
F		4		2	4	4	1		13
G		3	7	3	2	2	5	2	17
H		36	22	3	6	5	3	2	22
I		4	22	5			7	5	
J		1	1	2	1	1	5	1	2
K				2	2	2	3		11
L		1	2	2	2	2	3	1	12



LOCATION 7

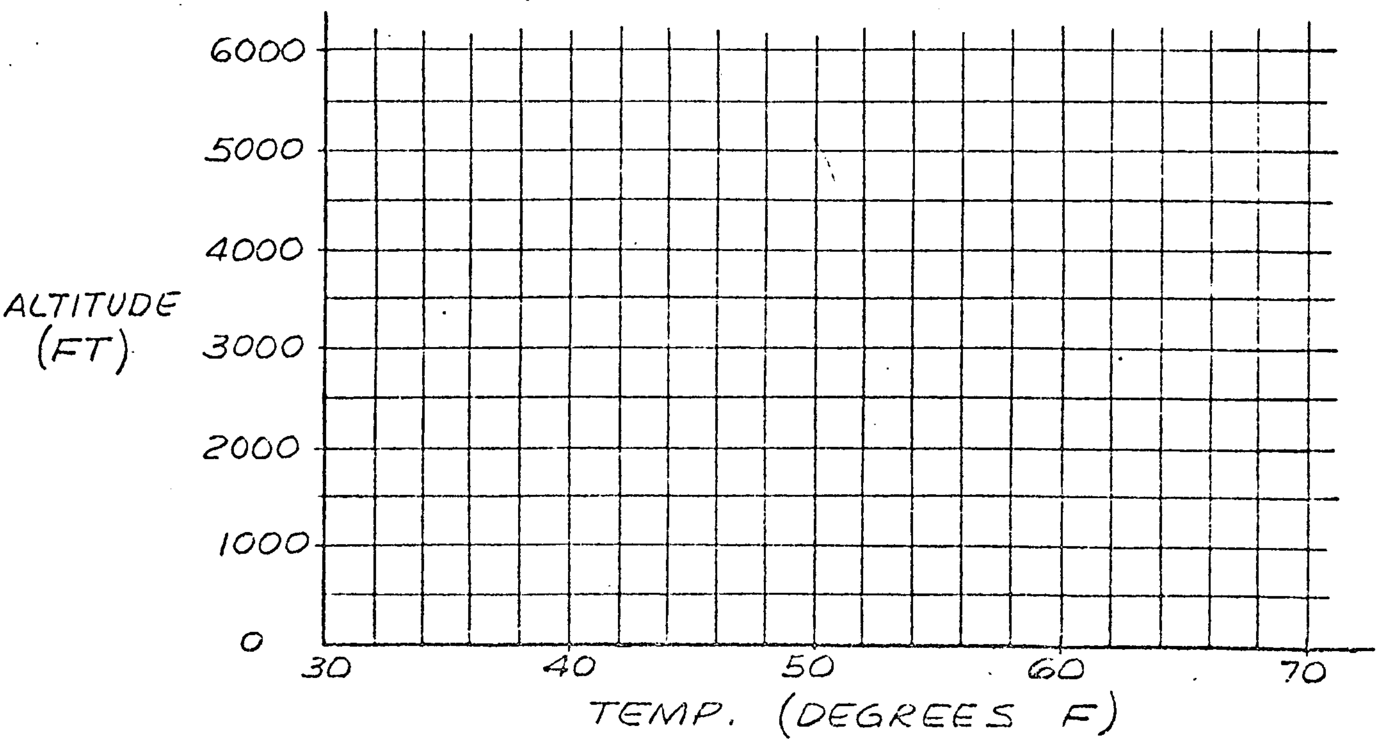
DATE : 14 DEC 1972 TIME: 10:00 AM P.S.T.

LOCATION	VISIBILITY (MILES)	NO (PPHM)	NO_2 (PPHM)	O_3 (PPHM)	HYDROCARBONS (PPM)	CH_4 (PPM)	CO (PPM)	SO_2 (PPHM)	PARTICULATE KM x 100
1	7								
2	30								
3									
4	25								
5									
6	7								
7									
8									
9									
A	8	14	10	1	2	2	5	2	43
B		4	4	2	2	2	3	2	24
C		16	16	2	3	3	9	2	52
D		18	15	2			13	3	45
E		14	13	3			4	1	60
F		11	12	1	5	4	5	1	35
G		3	4	2	2	2	4	1	30
H		33	12		4	3	13	2	55
I		6	7	2	4	3	4	1	
J		3	4	2	2	2	3	1	16
K		5	1	1	2	2	3		23
L		4	6	2	3	2	2	1	20



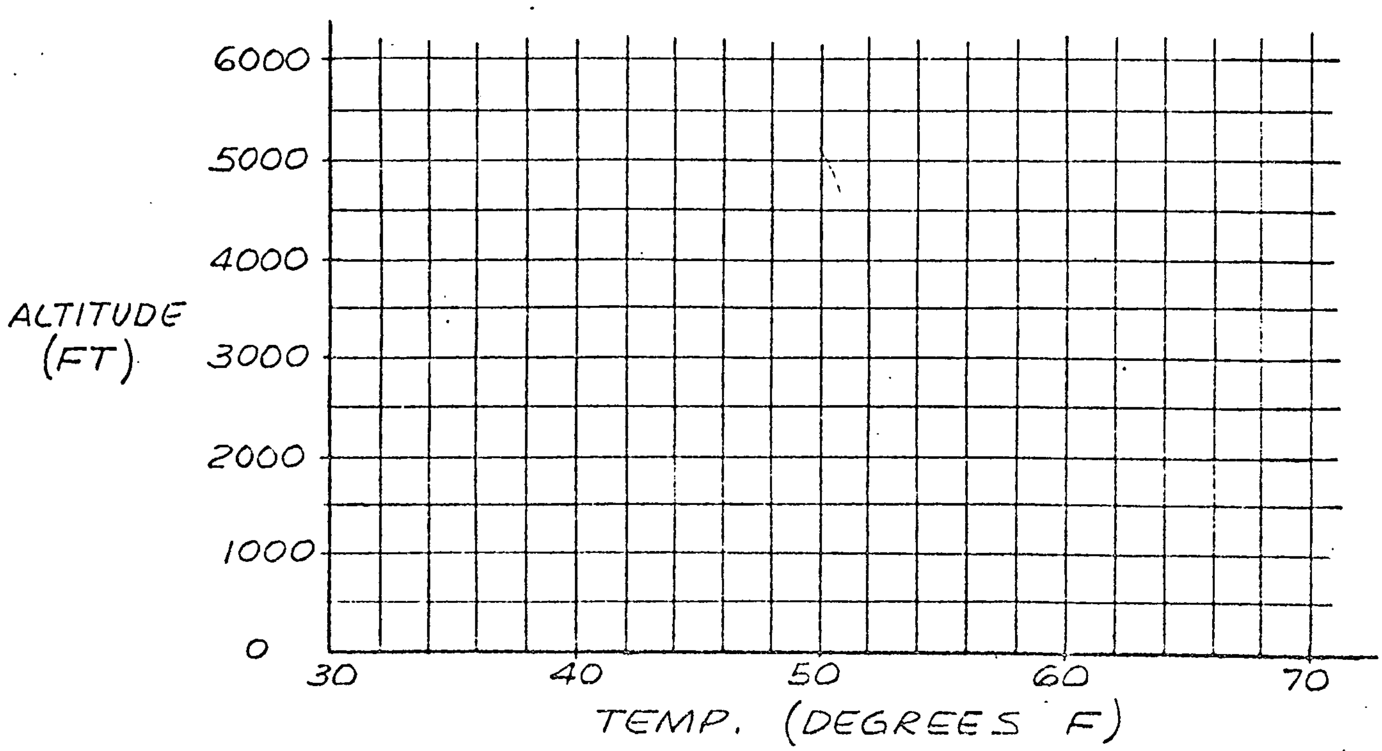
DATE: 1 JAN 1973 TIME: 10:00 AM P.S.T.

LOCATION	VISIBILITY (MILES)	NO (PPHM)	NO_2 (PPHM)	O_3 (PPHM)	HYDROCARBONS (PPM)	CH_4 (PPM)	CO (PPM)	SO_2 (PPHM)	PARTICULATE KM x 100
1	30								
2	50								
3									
4	3								
5									
6	15								
7									
8	20								
9									
A		1	1	2	1	1	2	1	3
B		1	1	5	2	2	2	6	15
C		1	1	2	2	2	1	2	6
D		1	1	3			1	1	8
E		1	1	3			1	2	15
F		1	1	3	3	3	1	1	15
G		1	1	3	1	1	3	1	7
H		4	3	3	3	3	3	1	5
I		1	1	4	2	2	1	1	
J		2	1	3	2	2	2	1	6
K		1	1	3	2	2	2		2
L		1	1	3	2	2	1	1	15



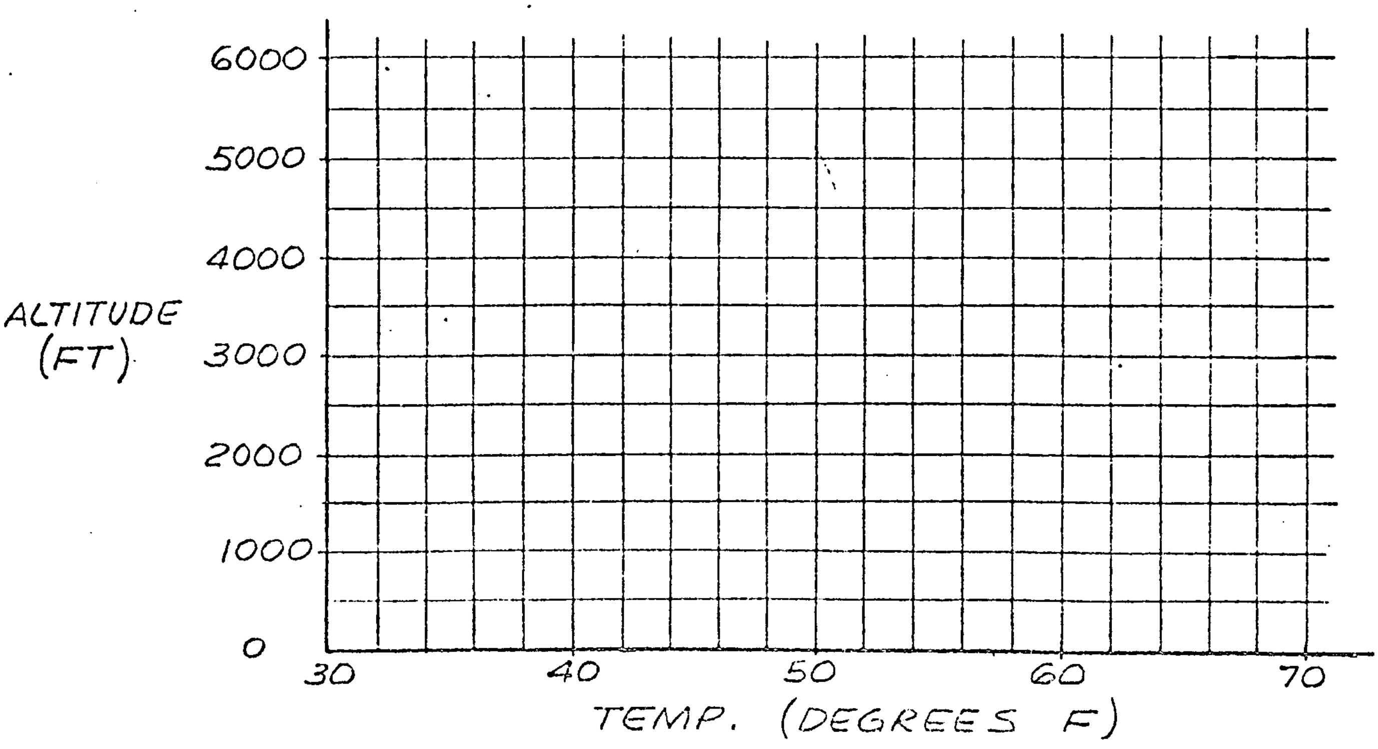
DATE : 19 JAN 1973 TIME: 10:00 AM P.S.T.

LOCATION	VISIBILITY (MILES)	NO (PPHM)	NO_2 (PPHM)	O_3 (PPHM)	HYDROCARBONS (PPM)	CH_4 (PPM)	CO (PPM)	SO_2 (PPHM)	PARTICULATE KM x 100
1	50								
2	40								
3									
4	30								
5									
6	45								
7									
8	20								
9									
A	40	2	3	3	1	1	2		9
B		1	1	5	3	3	2	1	7
C		2	2	1	2	2	2	1	5
D		7	6	2			3		8
E		5	4	4			1	1	16
F		2	4	2	3	3	2	1	10
G		4	3	2	2	2	3	1	12
H				1	2	2	3		15
I		1	2	2	2	2	2	1	
J		3	2	2	2	2	2	1	6
K		1	1	3	2	2	3		5
L		3	3	3	2	2	2	1	13



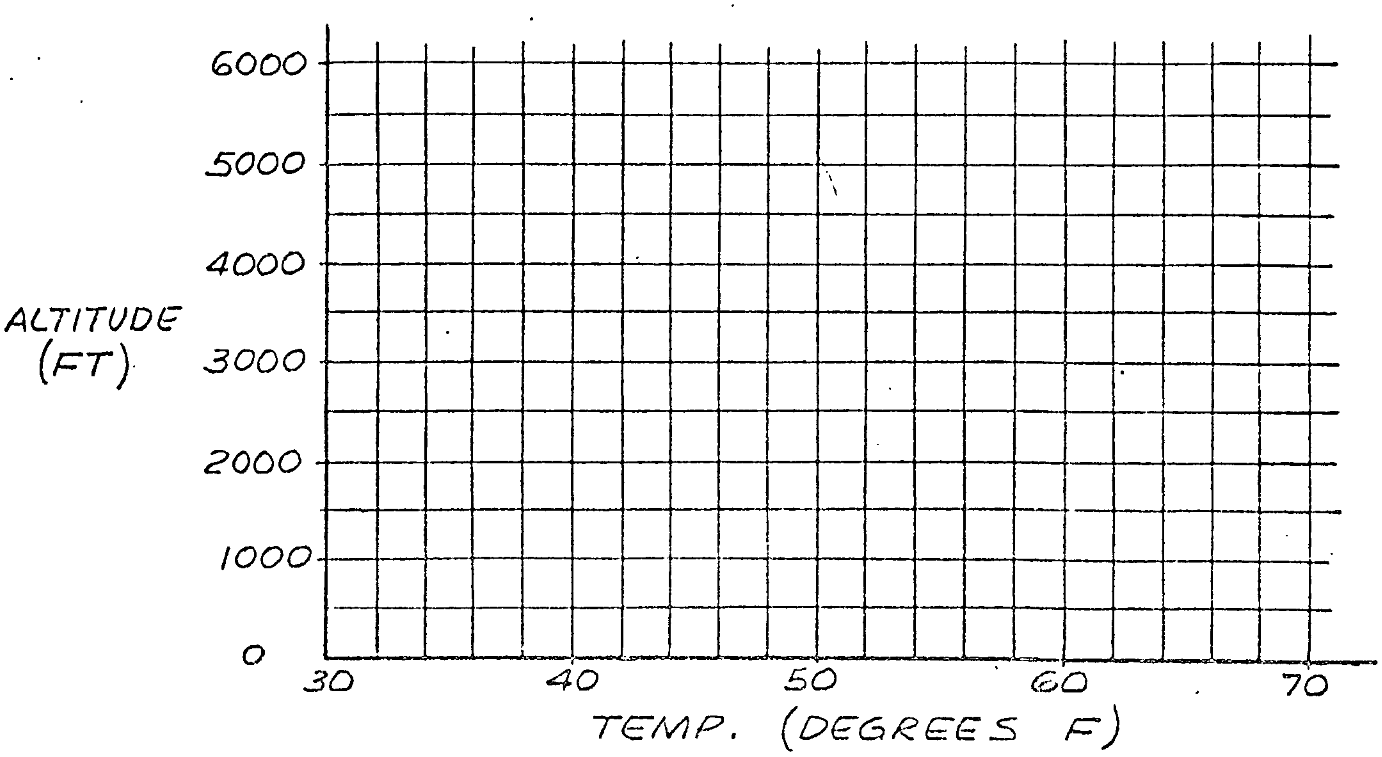
DATE : 6 FEB 1973 TIME: 10:00 AM P.S.T.

LOCATION	VISIBILITY (MILES)	NO (PPHM)	NO_2 (PPHM)	O_3 (PPHM)	HYDROCARBONS (PPM)	CH_4 (PPM)	CO (PPM)	SO_2 (PPHM)	PARTICULATE KM x 100
1	6								
2	7								
3									
4	3								
5									
6	5								
7									
8	20								
9									
A	8	11	4	2	2	1	4	2	28
B		1	1	2	2	2	1	1	13
C		5	4	2	2	2	3	1	13
D		11	7				4	1	22
E		4	3				3	1	30
F		5	5	3	3	3	2	1	17
G		3	3	2	2	2	4	1	15
H		17	4	2	2	2			26
I		7	5	3	3		4	2	
J		3	3	2	2	2	2	1	2
K		1	1	2	2	2	2	2	5
L		3	4	2	2	2	3	1	9



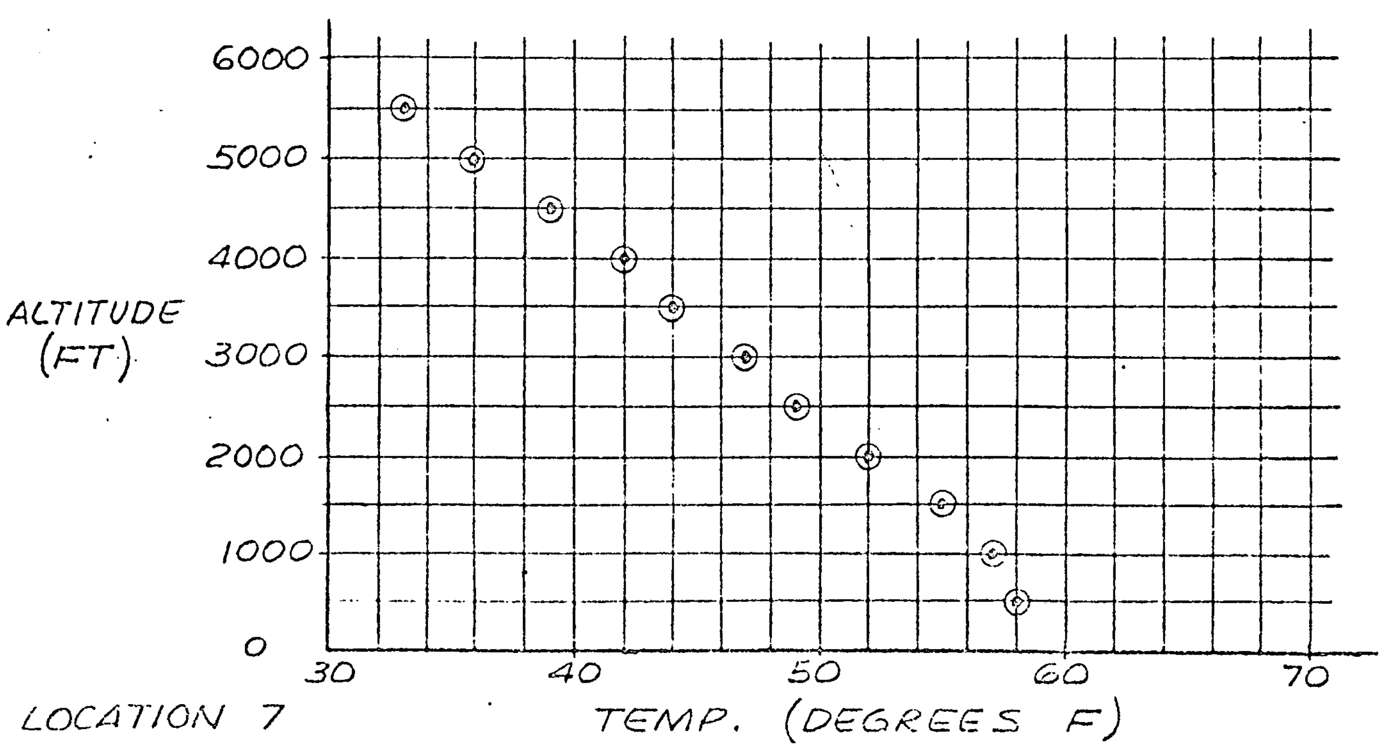
DATE : 24 FEB 1973 TIME: 10:00 AM P.S.T.

LOCATION	VISIBILITY (MILES)	NO (PPHM)	NO_2 (PPHM)	O_3 (PPHM)	HYDROCARBONS (PPM)	CH_4 (PPM)	CO (PPM)	SO_2 (PPHM)	PARTICULATE KM x 100
1	4								
2	3								
3									
4	3								
5									
6	6								
7									
8	10								
9									
A	5	1	5	2	2	1	3	1	15
B		5	8	3	3	3	3	2	34
C		5	6	2	2	2	3	2	15
D		3	7				5	1	13
E		4	5				1	1	24
F		2	7	3	3	3	2	1	17
G		6	4	2	2	3	4	1	12
H		16	6	3	3	2	4	3	20
I		2	4	2	2	2	2	3	
J		1	4	2	2	2	2	1	13
K		1	1	2	2	2	2	1	7
L		4	8	3	3	2	4	2	33



DATE : 14 MARCH 1973 TIME: 10:00 AM P.S.T.

LOCATION	VISIBILITY (MILES)	NO (PPHM)	NO_2 (PPHM)	O_3 (PPHM)	HYDROCARBONS (PPM)	CH_4 (PPM)	CO (PPM)	SO_2 (PPHM)	PARTICULATE KM x 100
1	50								
2	40								
3	25								
4	55								
5	> 15								
6	50								
7									
8	35								
9	20								
A	30	1	1	3	2	1	2	1	9
B		1	1	2	2	2	2	1	6
C		3	2	1	2	2	2	2	2
D		1	2	2			3	1	7
E		1	3	3			1	1	25
F		1	2	3	3	3	1	1	9
G		5	3	2	2	2	4	1	12
H		10	4	1	2	1	2	1	10
I		2	2	3	2	2	2	1	
J		1	1	3	2	2	4	1	8
K		1	1	4	2	2	2		6
L		1	2	3	2	2	1	1	7



LOCATION 7

Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

Fig. 6

Fig. 7

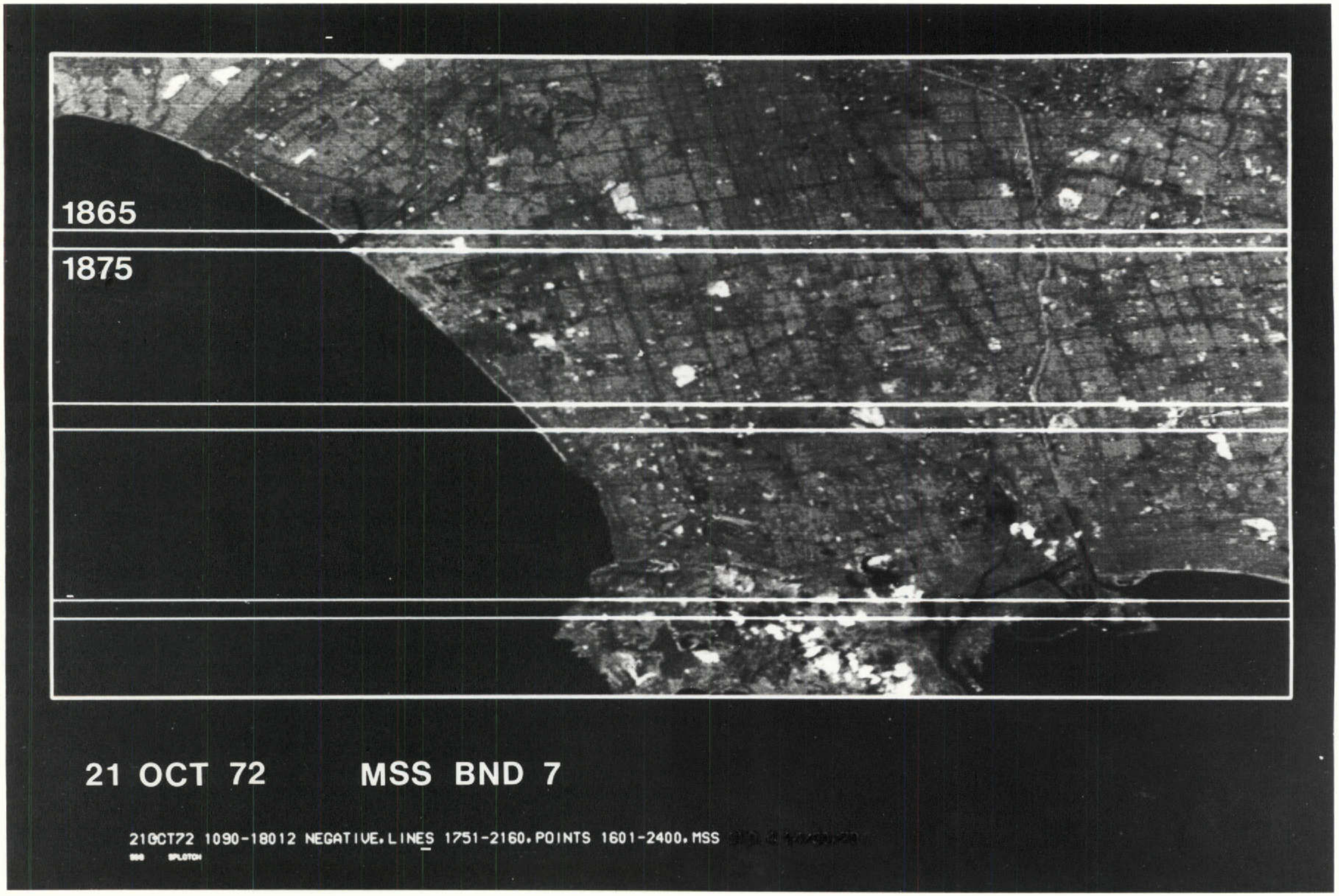

1865
1875
21 OCT 72
MSS BND 7
21OCT72 1090-18012 NEGATIVE.LINES 1751-2160.POINTS 1601-2400.MSS

Fig. 8

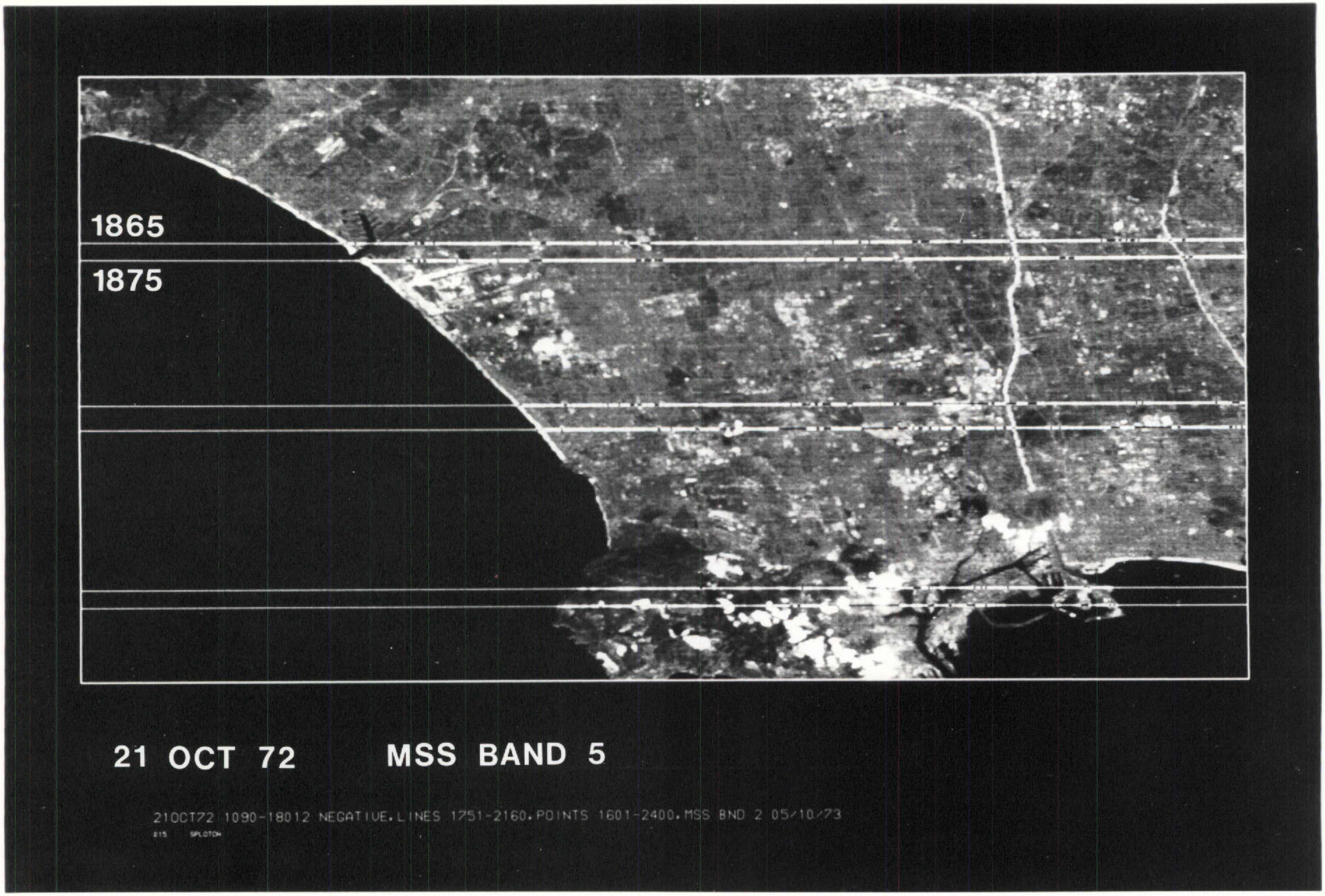

1865
1875
21 OCT 72
MSS BAND 5
21OCT72 1090-18012 NEGATIVE.LINES 1751-2160.POINTS 1601-2400.MSS BND 2 05/10/73
SPLOTCH

Fig. 9

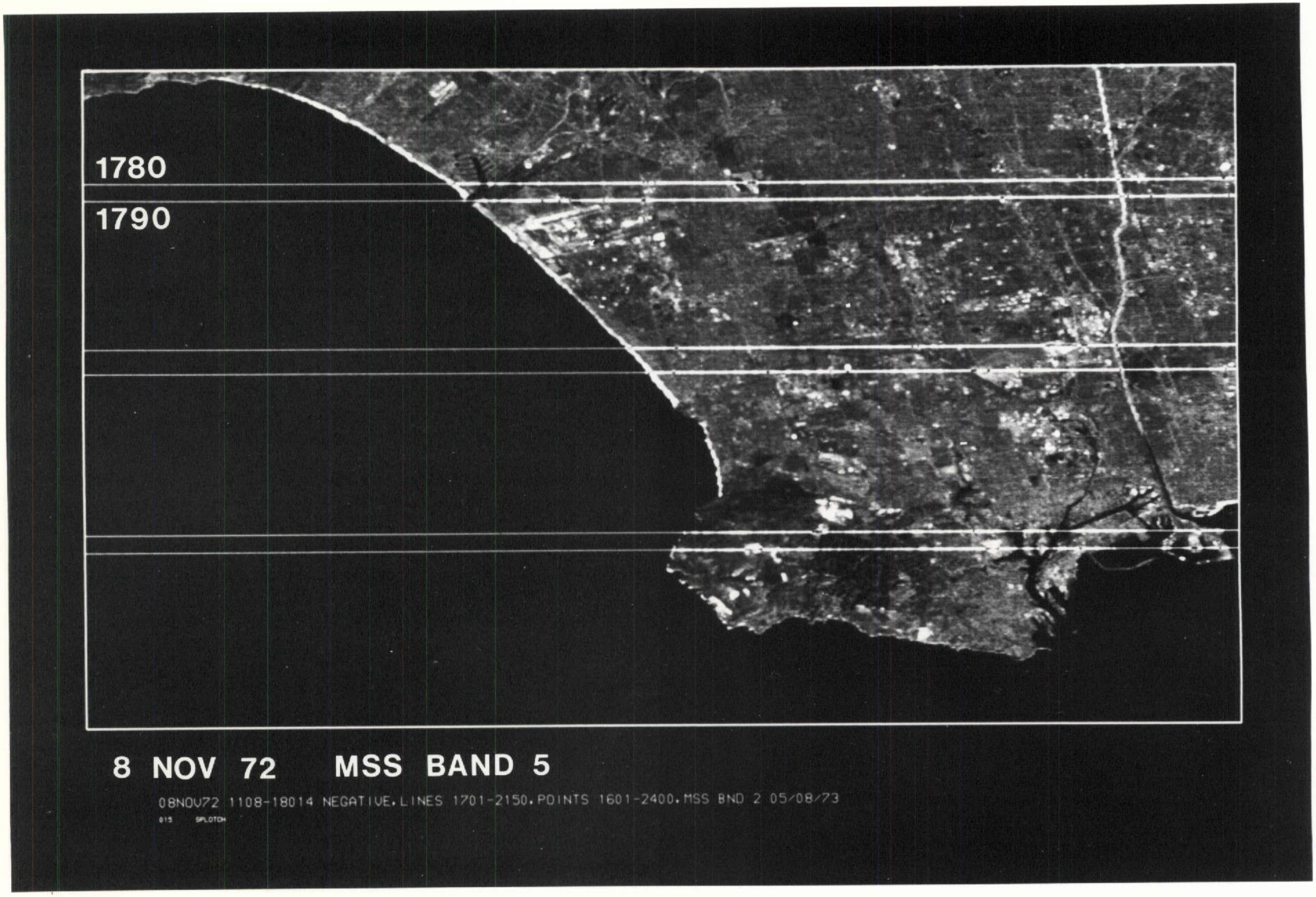
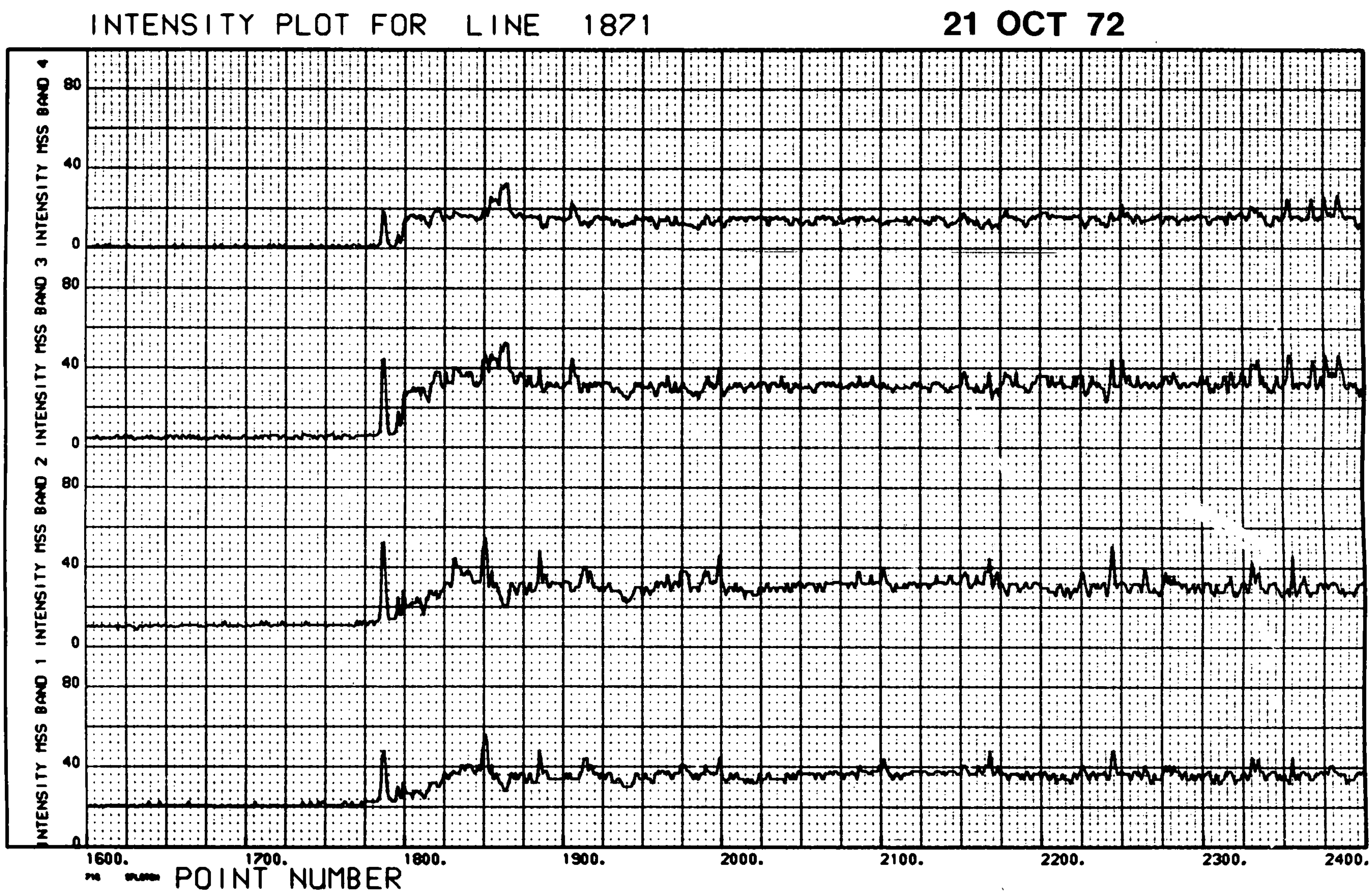

1780
1790
8 NOV 72 MSS BAND 5
08NOV72 1108-18014 NEGATIVE.LINES 1701-2150.POINTS 1601-2400.MSS BND 2 05/08/73
015 SPLOTCH

Fig. 10



INTENSITY PLOT FOR LINE 1871
21 OCT 72
INTENSITY MSS BAND 1 INTENSITY MSS BAND 2 INTENSITY MSS BAND 3 INTENSITY MSS BAND 4
80
40
0
1600.
1700.
1800.
1900.
2000.
2100.
2200.
2300.
2400.
POINT NUMBER

Fig. 11

INTENSITY PLOT FOR LINE 1788 **8 NOV 72**

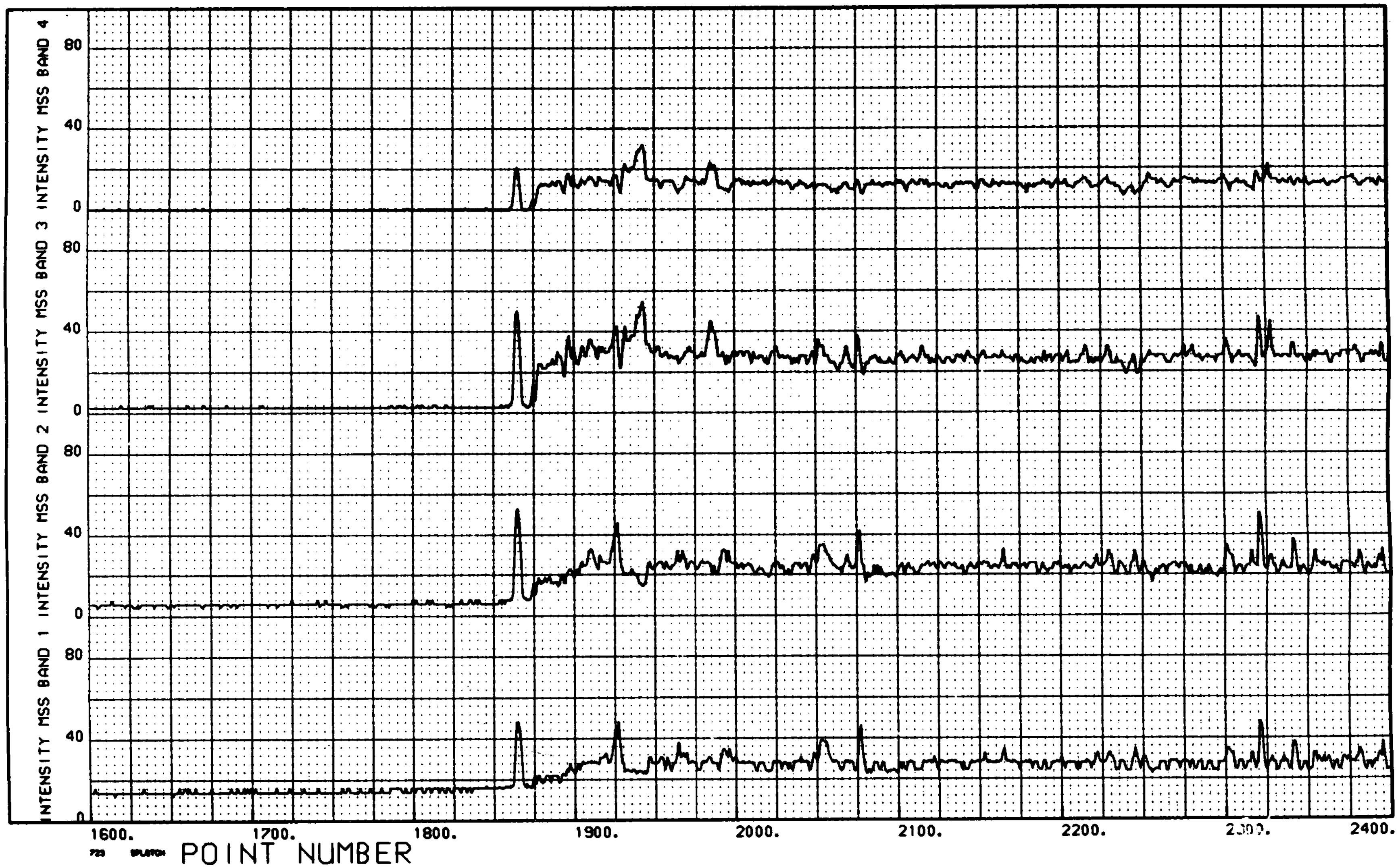


Fig. 12